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A new intermediate host of *Staphylocystis furcata* (Stieda, 1862) Spassky, 1950, and some data on the formation of larvocysts of this tapeworm

Nowy żywiciel pośredni *Staphylocystis furcata* (Stieda, 1862) Spassky, 1950 oraz pewne dane o kształtowaniu się larwocyst tego tasiemca

In the course of my research on the development cycles and biology of tapeworms of small insectivorous mammals in the Białowieża National Park between June and October 1957, I found repeatedly larvae which I denoted as developmental forms of *Staphylocystis furcata* (Stieda, 1862) Spassky, 1950. The basis of the denotation was a comparison with the data concerning adult specimens (Table I) and with a description by Joyeux et Baer (1936) of the larva of this tapeworm species.

Staphylocystis furcata [synonyms: *Taenia furcata* Stieda, 1862; *Lepidotrias furcata* (Stieda, 1862) Cohn, 1869; *Weinlandia furcata* (Stieda, 1862) Mayhew, 1925; *Hymenolepis furcata* (Stieda, 1862) Meggitt, 1924; *Dicranotaenia* (*Dicranotaenia*) *furcata* (Stieda, 1862) Lopez-Neyra, 1942; *Dicranotaenia furcata* (Stieda, 1862) Skrjabin et Mathevossian, 1945, 1948] has occurred according to the present data in the following *Insectivora*: *Sorex araneus araneus* L., *Neomys fodiens* Schreb., *Crocidura leucodon* Herm., *Crocidura murina* (L.), *Crocidura caerulea* (Kerr.) (Joyeux et Baer, 1936; Skrjabin et Mathevossian, 1948; Sołtys, 1952, 1954; Żarnowski, 1955). This species was found in the Białowieża National Park in *Sorex araneus araneus* L. and *Neomys fodiens* Schreb. (Sołtys, 1952, 1954).

Table I

Comparison of the dimensions of the scolex in adult specimens and cysticercoids of *Staphylocystis furcata* (in μ)

Forms	Author	Scolex diameter	Rostellum		Suckers diameter	Number of hooks	Length of hooks
			length	width			
Adult forms	Joyeux et Baer, 1936	210	—	—	—	22—28	26—28
„	Skrjabin et Mathevossian, 1948	125	—	70	—	25	19—24
„	Sołtys, 1952	200	100	80	80	28	25
„	Żarnowski, 1955	170—270	60—85	40—87	60—97	15—24	17—26
„	Kisiielewska	260—300	—	86—92	72—101	24—26	24—28
Cysticercoids	Kisiielewska	—	—	80—109	56—80 $\times$ 52—76	24—28	20—28

Description of the larvocyst

A cursory description of the larvae of *Hymenolepis furcata* (Stieda, 1862) (synonym of *Staphylocystis furcata* (Stieda, 1862) Spassky, 1950) was given by Joyeux et Baer (1936). According to those authors cysticercoids of *Hymenolepis furcata* show a well developed external coat which surrounds the cyst proper and detaches from it fairly easily. The cyst proper measures 250 by 180 μ , rostellum 100 μ , suckers 60 μ . There is no reference to the imaginal hooks, their shape, size and number.

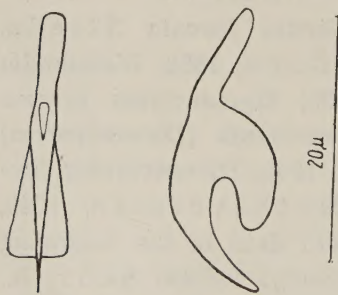


Fig. 1. Imaginal hook of *Staphylocystis furcata*; frontal and lateral position

As I found numerous larvae of *Staphylocystis furcata* I can supplement this description. According to my observations the cysticercoid proper (a cyst containing a scolex) is surrounded with a cuticular screen with a striated surface. Length 222—335 μ ; width 161—331 μ , shape spherical, slightly elongate, or pyriform. Scolex furnished with 4 very fleshy, almost spherical suckers (56—80 $\times$ 52—76 μ), and a wide rostellum (80—109 μ) furnished with

a compact crown of hooks (Fig. 1, 2). The number of hooks amounts to 24, 26, 28 and in one case to 27. The length of a hook varying from 20 to 28 μ . In frontal position the guard of the hook looks like a flat spatulate formation (Fig. 1), this fact being pointed

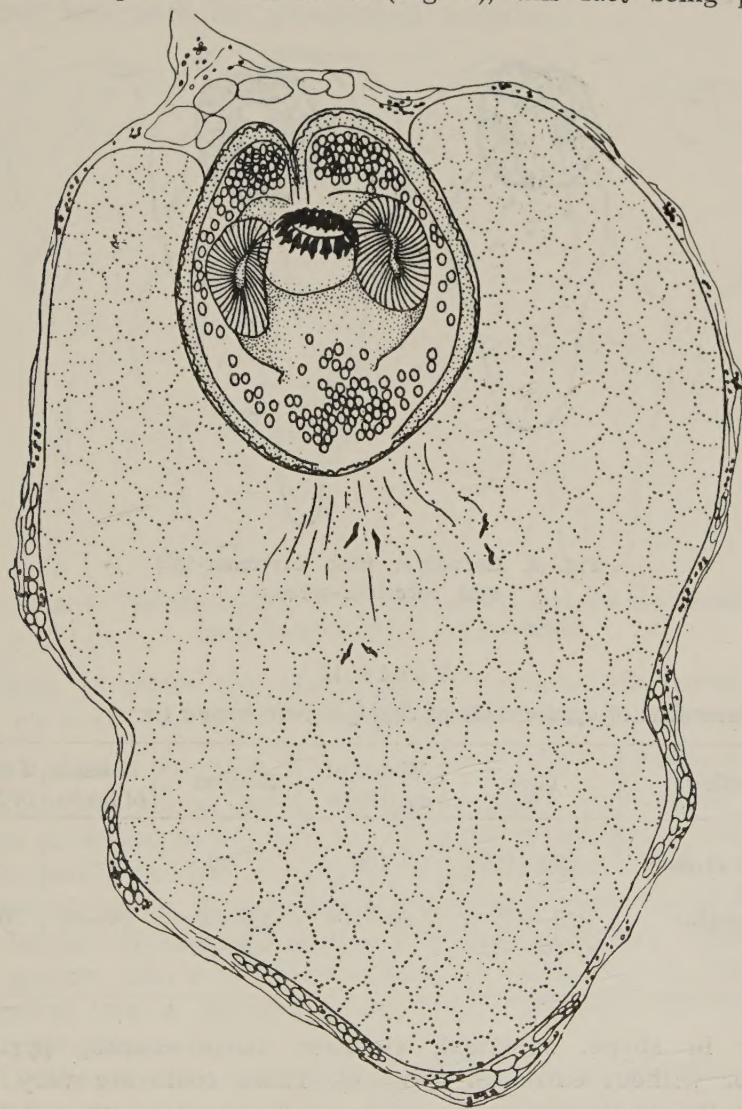


Fig. 2. Larvocyst of *Staphylocystis furcata*

out also by Żarnowski (1955) in reference to adult specimens. Calcareous bodies grouped in two anterior protruding roundings

of the cyst and at its posterior pole (Fig. 2). Cysticercoids possessing cercomers, either mace-shaped or growing almost all round the cyst (Fig. 3). The process of circumcrescence is presumed to go on while the cysticercoid develops. Cercomer-coat varying

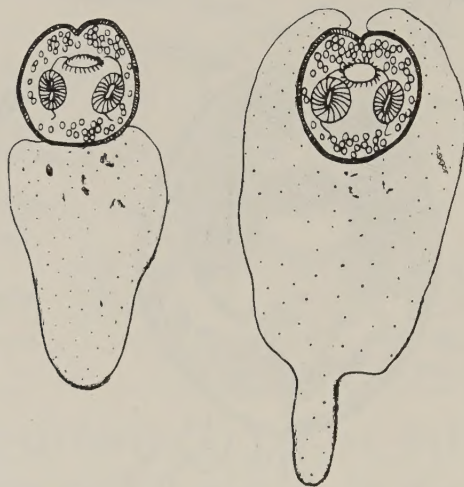


Fig. 3. Larvocyst with cercomer-tail and cercomer-screen

Table II

Dimensions of cysticercoids of *Staphylocystis furcata* (in μ)

Author	Cyst	Width of restellum	Suckers	Number of hooks	Length of hooks
Joyeux et Baer 1936	250×180	100	60	—	—
Kisielevska	222—335 × × 161—331	80—109	56—80 × × 52—76	24—28	20—28

widely in shape: spherical, elongate, barrel-shaped, pyriform; with or without extra tail (Fig. 4). These coats are very large so that the whole larvocyst may reach 2 mm in width and 5 mm in length. Cysts often join each other by means of these coats in groups of two, three or four, thus forming cell substance with cysts suspend in it (Fig. 5). I have never observed however the

boundaries between separate coats to become effaced, and when manipulated with a preparation needle such conglomerations easily split single larvocysts. Embryonal hooks (14 to 16 μ long) (Fig. 4) were often observed in the screens, which suggested that we deal here with the transformed cercomers.

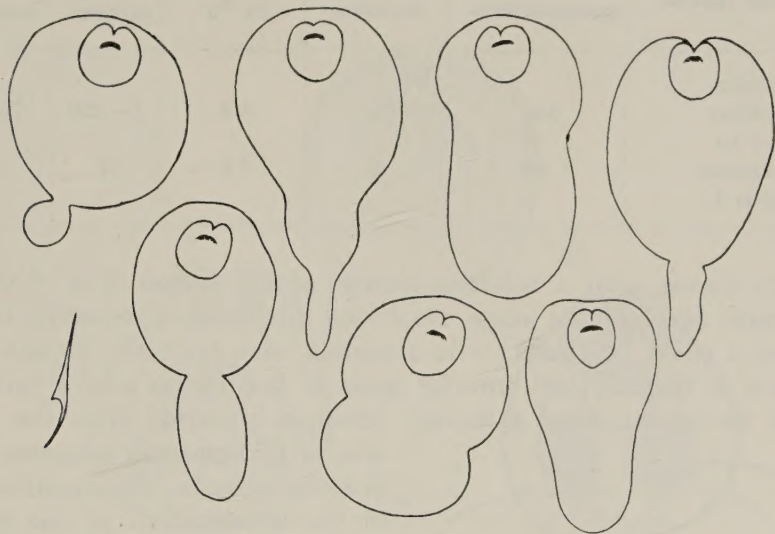


Fig. 4. Various shapes of cercomer-screen and the embryonal hook from cercomer of larvocyst

Table II shows the dimensions of cysticercoids (according to Joyeux et Baer, 1936 and Kisielewska).

Some data on the formation of the cysticercoid

Numerous larval forms of *Staphylocystis furcata* in various stages of development were found in two specimens of *Geotrupes stercorosus* Scriba. In both cases the intensity of invasion exceeded 50 larvae. It was possible to choose from this rich material larvae representing several development stages. Joined with one another into a whole by means of reconstruction, they gave a general idea of the formation of the cysticercoid in *Staphylocystis furcata*.

(1) The earliest development forms I found are larvae with a developing lacuna primitiva (Fig. 6a). They are elongate, wider in front. The posterior part is narrower and has 3 pairs of embryonal hooks (14—15 μ long). These forms are 359—640 μ in length and 262—347 μ in maximum width.

Table III

Invasion extensity and intensity in intermediate hosts in the Białowieża National Park

Host species	Number of post-mortems	Number invaded	Extensity in %	Intensity	
				extreme	average
<i>Geotrupes stercorosus</i> Scriba	342	28	8.4	1—150	16.1
<i>Pterostichus vulgaris</i> L.	26	1	3.8	7	—

(2) Forms with a infolded anlage of the scolex (Fig. 6 b) are the next development stage. No forms intermediate between forms 1 and 2 could be found. It is supposed that after the lacuna primitiva is formed, the anterior pole of the larva, where cells to form the scolex have gathered, becomes infolded. Thus the process of invagination precedes that of scolicogenesis. This modification in the development of the cysticercoids of *Hymenolepididae* is mentioned by Skrjabin et Mathevossian (1945). Forms with an infolded scolex anlage measure as follows: cercomer

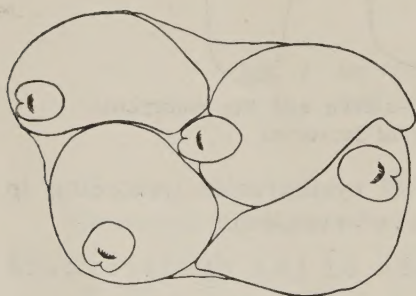


Fig. 5. Four larvocysts of *S. furcata* connected with screens

270—281 μ long, 178—184 μ wide; anterior part of the larva (with the future scolex) 279—285 $\times$ 271—276 μ .

(3) Various elements of the scolex become differentiated (scolicogenesis) in further larval forms, the walls of the cyst surrounding the scolex become thick and covered with a cuticular screen with a striated pattern; calcary bodies appear. The first to appear in the process of scolicogenesis are the suckers and the rostellum (Fig. 6 c), then imaginal hooks form on the rostellum already formed which are still non-typical in shape and smaller than the normally developed ones (Fig. 6 d). The cercomer grows, becomes cordiform and reaches 258—267 μ in length and 206—218 μ in maximum width at the base during this development period. Cysts

with the scolex yet without imaginal hooks or with their anlagen are $254\text{--}268\text{ }\mu$ wide and $298\text{--}321\text{ }\mu$ long. Scolex $222\text{--}245\text{ }\mu$ wide; suckers $64\text{--}67 \times 75\text{--}78\text{ }\mu$, rostellum $76\text{--}81\text{ }\mu$ wide. When the hooks have developed another screen developing from the cercomer grows round the cyst.

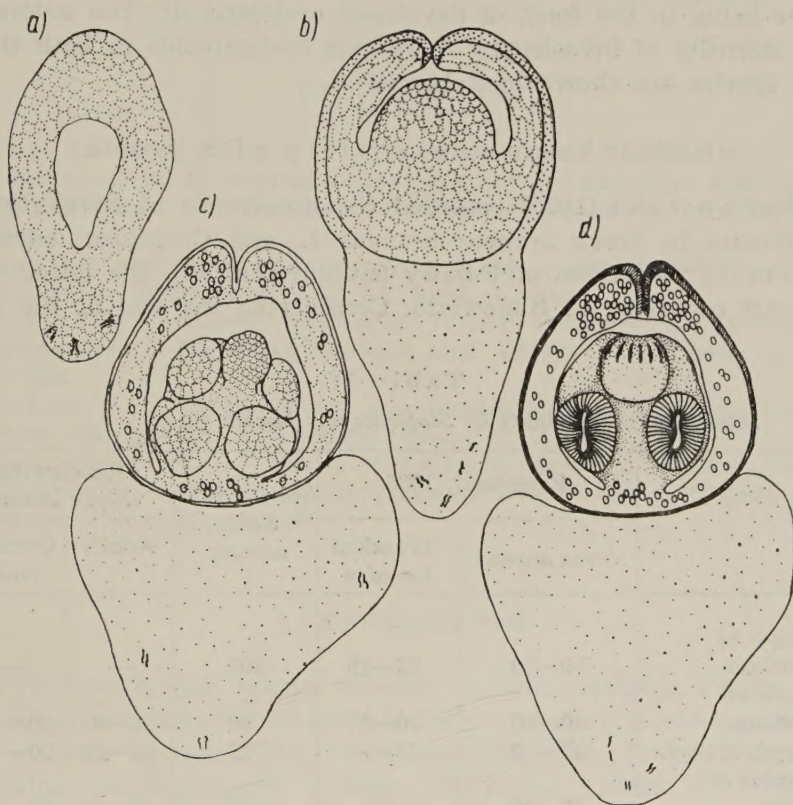


Fig. 6. Successive stages of the formation of *S. furcata* cysticercoid: a — form with lacuna primitiva forming; b — form with infolded anlage of scolex; c — form with scolex forming inside cyst; d — form with imaginal hooks forming on scolex

The intermediate host

Staphylocystis furcata cysticercoids were first found by Linstow in 1893 in *Geotrupes sylvaticus* Panz. (Skrjabin et Mathevossian, 1945). Then they were observed in France

(Fontainebleau) in the same insect species (Joyeux et Baer, 1936). Invasion extensity amounted to 10⁰%.

I found *Staphylocystis furcata* cysticercoids in two insect species in the Białowieża National Park: *Geotrupes stercorosus* Scriba (synonym *Geotrupes sylvaticus* Panz.) (Scarabeidae) and *Pterostichus vulgaris* L. (Carabidae), all the larvae observed in the latter being in the form of developed cysticercoids. The extensity and intensity of invasion by *S. furcata* cysticercoids in both these host species are shown in Table III.

Remarks on variability of *S. furcata*

Żarnowski (1955) recorded the occurrence of *Staphylocystis furcata* in *Sorex araneus araneus* L. and *Crocidura leucodon* Herm. in the region of Puławy (Lublin District), the latter species not occurring at Białowieża. Considering the size of the ros-

Table IV
Intra-specific variability in *Staphylocystis furcata* (in μ)

	Żarnowski, 1955		Soltys, 1952 <i>Sorex araneus</i>	Kisielevska <i>Sorex araneus</i>	
	<i>Sorex araneus</i>	<i>Crocidura leucodon</i>		Adults	Cysticercoids
Length of rostellum	60—70	75—85	100	—	—
Width of rostellum	40—60	70—87	80	86—92	80—109
Length of hooks	17—19	23—26	25	24—28	20—28
Number of hooks	15—20	24	28	24—26	24—28

tellum and the number and length of hooks, Żarnowski believed that his material showed a clear division into two groups of specimens of which one is typical of *Sorex araneus* (smaller size) and the other of *Crocidura leucodon* (larger size).

The findings of Soltys (1952) concerning adult specimens of *S. furcata* as well as my own observations of adult specimens and cysticercoids of this tapeworm suggest that *S. furcata* from *Sorex araneus* of the Białowieża National Park have the rostell-

lum and hooks of the same size and the same number of hooks as specimens typical of *Crocidura leucodon* of the area of Puławy. These findings are illustrated in Table IV.

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Warszawa, Pasteura 3

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STRESZCZENIE

Przeprowadzając sekcję owadów z Białowieskiego Parku Narodowego w poszukiwaniu larw tasiemców drobnych ssaków, autorka znalazła cysticerkoidy, które określiła (tab. I) jako postacie larwalne *Staphylocystis furcata* (Stieda, 1862) Spassky, 1950 — tasiemca, pasożytniczego u *Insectivora*, a w Białowieży stwierdzonego u *Sorex araneus* L. i *Neomys fodiens* Schreb. (Sołtys, 1952, 1954).

Pobieżny opis larw *S. furcata* podają Joyeux et Baer (1936), nie uwzględniając ważnych cech diagnostycznych, jak liczba, kształt i wielkość haków imaginalnych. Autorka podaje szczegółowy opis tych postaci larwalnych (rys. 1, 2). Cysticerkoidy mają grube, buławkowate cerkomery, które prawdopodobnie w czasie rozwoju obrastają cystę tworząc otoczkę (rys. 3) o różnych kształtach (rys. 4). Za pośrednictwem tych otoczek larwy łączą się po 2—4 (rys. 5). W otoczkach często spotykano haczyki embrionalne

(rys. 4). Zestawienie wymiarów cysticerkoidów według Joyeux et Baer (1936) i autorki przedstawia tabela II.

W dwóch okazach żywicieli pośrednich znaleziono liczne larwy *S. furcata* różnicowane pod względem rozwoju. Dzięki temu, drogą rekonstrukcji, udało się autorce przedstawić ogólny obraz powstawania cysticerkoida u *S. furcata*:

1. Larwy z tworzącą się jamą pierwotną (lacuna primitiva) — rys. 6 a.

2. Larwy z wpuklonym zaczątkiem skoleksa, z czego należy wnosić, że inwaginacja wyprzedza tu skolikogenezę — rys. 6 b.

3. Larwy w okresie skolikogenezy i powstawania haków — rys. 6 c, d.

Cysticerkoidy *S. furcata* zostały znalezione po raz pierwszy przez Linstow'a (1893) u *Geotrupes sylvaticus* Panz., a następnie na terenie Francji u tegoż żywiciela przez Joyeux et Baer (1936). W Białowieskim Parku Narodowym autorka znajdowała je również u *Geotrupes stercorosus* Scriba (syn. *G. sylvaticus*), a także u nie notowanego dotąd gatunku żywicielskiego — *Pterostichus vulgaris* L. (*Carabidae*) (tab. III).

Zmienność gatunkową *S. furcata* w zależności od terenu i gatunku żywiciela ostatecznego ilustruje tab. IV.